PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-308142

(43)Date of publication of application : 05.11.1999

(51)Int.Cl. H04B 1/40
H04B 1/04

(21)Application number : 10-110747

(22)Date of filing : 21.04.1998

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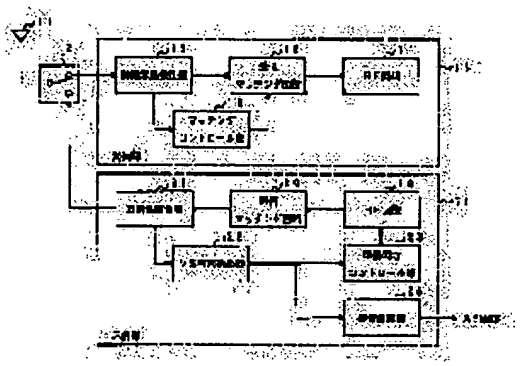
(54) PORTABLE COMMUNICATION EQUIPMENT

(57)Abstract:

PROBLEM TO BE SOLVED: To compensate the operation characteristics of an antenna changed by a distance from a user and to suppress influence on a human body as much as possible by matching impedance between the antenna and a reception circuit based on the measured result of the characteristics of the antenna and varying the transmission output of a transmission circuit further.



SOLUTION: At the time of the operation of a reception part 13 and a transmission part 14, a capacitance detector 15 and a VSWR detector 22 detect the capacitance and VSWR with a case body of the antenna 11 changed corresponding to the distance from the user. By control signals outputted by a matching control part 18 corresponding to the capacitance, a reception matching circuit 16 performs matching with the impedance of the antenna 11. Also, corresponding to the VSWR, a transmission output control part 23 appropriately controls the output level of the high frequency signals of an RF circuit 19. Thus, reception is performed by high antenna efficiency at all times and the influence of the antenna on the human body of the user is suppressed as much as possible.

LEGAL STATUS

[Date of request for examination]

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[Date of extinction of right]

JAPANESE [JP,11-308142,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to pocket communication devices, such as a a digital cellular phone terminal and a PHS terminal.
[0002]
[Description of the Prior Art] carrying of recently, a a digital cellular phone terminal, a PHS (Personal Handyphone System:short form cordless telephones system) terminal, etc. -- the spread of the terminals of an usable telephone system is progressing quickly
[0003] In this kind of pocket transmitter, as shown in drawing 2 , at the time of use, an antenna 1 will approach or contact a user's human body head 2 extremely. Therefore, the technical problem that electric field strong in this head 2 occurred occurred. Moreover, the property changed a lot because an antenna 1 approaches the human body head 2, and there was also fault that antenna actual gain will fall.
[0004]
[Problem(s) to be Solved by the Invention] As mentioned above, electric field strong in this head arose, the human body might be affected, and it had the technical problem that it might fall also in an operating characteristic because an antenna approaches or contacts a human body head in a general pocket transmitter at the time of use.
[0005] It is in offering the pocket communication device to which this invention was made in view of the above actual condition, and the place made into the purpose carries out influence which it has on a user's human body on the occasion of use few, and an operating characteristic is not reduced.
[0006]
[Means for Solving the Problem] The receiving circuit to which invention according to claim 1 performs reception to the electric wave received with an antenna and this antenna, The impedance adjustable means which is arranged between the above-mentioned antenna and a receiving circuit, and carries out adjustable [of the impedance matching state between these], It is characterized by providing a measurement means to measure the property of the above-mentioned antenna, and the control means which control the above-mentioned impedance adjustable means based on the measurement result of this measurement means, and take the impedance matching between the above-mentioned antenna and a receiving circuit.
[0007] The operating characteristic of the antenna which changes according to the distance of a user's human body and an antenna on the occasion of such composition, then use can be compensated, and reception operation by always high antenna efficiency can be performed.
[0008] Invention according to claim 2 is characterized by providing an antenna, the sending circuit which sends out and excites a RF signal at this antenna, a measurement means to measure the property of the above-mentioned antenna, and the control means which carry out adjustable control of the transmitting output of the above-mentioned sending circuit based on the measurement result of this measurement means.
[0009] The influence which gives a transmitting output to a user's human body on the occasion of use by

carrying out adjustable control from the property of the antenna which changes according to the distance of a user's human body and an antenna on the occasion of such composition, then use can be suppressed as much as possible.

[0010] Invention according to claim 3 is characterized by the above-mentioned measurement means detecting the electrostatic capacity of an antenna in invention the above-mentioned claim 1 or given in two. Since detection by the low frequency band is sharply performed as compared with the RF signal used for communication in addition to an operation of invention such composition then the above-mentioned claim 1, or given in two, fully let influence on communication operation which measurement takes be a low thing.

[0011] Invention according to claim 4 is characterized by the above-mentioned measurement means detecting VSWR (voltage standing wave ratio) of an antenna in invention the above-mentioned claim 1 or given in two. In addition to an operation of invention such composition then the above-mentioned claim 1, or given in two, reception or a send action can be performed, maintaining antenna efficiency in the high state.

[0012]

[Embodiments of the Invention] With reference to a drawing, one gestalt of operation of this invention is explained below. Drawing 1 shows a part of circuitry at the time of applying to for example, a PHS terminal, 11 is an antenna which performs sending-out reception, and this antenna 11 is connected with a receive section 13 and the transmitting section 14 through the antenna switch 12. Here, the antenna switch 12 carries out change operation a predetermined period with the signal from the control circuit which is not illustrated, and the TDD (time-sharing duplex) method with which it takes to this and a receive section 13 and the transmitting section 14 repeat reception operation and a send action by turns is taken.

[0013] A receive section 13 consists of the electrostatic capacitive detector 15, a reception matching circuit 16, an RF circuit 17, and the matching control section 18. The electrostatic capacitive detector 15 is process in which the electric wave received with the antenna 11 through the antenna switch 12 is transmitted to the reception matching circuit 16, detects that the electrostatic capacity between an antenna 11 and the housing of this terminal changes according to the distance between an antenna 11 and the human body of the user of this terminal, and outputs the detection result to the above-mentioned matching control section 18.

[0014] The matching control section 18 sends out the control signal corresponding to the detection result in the electrostatic capacitive detector 15 to the reception matching circuit 16. By changing the impedance to the RF signal with which the reception matching circuit 16 is transmitted from the electrostatic capacitive detector 15 based on the control signal from this matching control section 18 Matching with the impedance of the antenna 11 which changes according to the distance between the human bodies of the user of this terminal is taken, and it outputs to the RF circuit 17 of the next step.

[0015] In the RF circuit 17, the local oscillation signal of predetermined frequency is superimposed on the input signal of the inputted RF, an intermediate frequency signal is obtained, and it sends out to the processing circuit of the latter part which does not illustrate this. On the other hand, the transmitting section 14 consists of the RF circuit 19, the transmitting matching circuit 20, a directional coupler 21, a VSWR detector 22, the transmitting output control section 23, and the warning generating section 24.

[0016] By superimposing the local oscillation signal of predetermined frequency on the intermediate frequency signal sent from the processing circuit of the transmitting system which is not illustrated, the RF circuit 19 acquires a RF signal and sends out the acquired RF signal to the transmitting matching circuit 20.

[0017] In the transmitting matching circuit 20, after taking predetermined impedance matching to the sent signal, it outputs to a directional coupler 21. While a directional coupler 21 carries out the transmitting output of most sending signals of the sent RF from an antenna 11 through the above-mentioned antenna switch 12, it branches and sends out a part to the VSWR detector 22.

[0018] The VSWR detector 22 detects VSWR (voltage standing wave ratio) of the signal sent from the directional coupler 21 which changes according to the distance between an antenna 11 and the human

body of the user of this terminal, and outputs the detection result to the transmitting output control section 23 and the warning generating section 24.
[0019] The transmitting output control section 23 is controlled to suppress the output of the sending signal which the above-mentioned RF circuit 19 outputs according to the degree, when it is judged that the antenna 11 is extremely close to the human body of the user of this terminal according to the value of VSWR detected with the VSWR detector 22.
[0020] warning -- generating -- the section -- 24 -- VSWR -- a detector -- 22 -- having detected -- VSWR -- a value -- predetermined -- a threshold -- comparing -- things -- the need -- an alarm signal -- generating -- a sending signal -- frequency -- controlling -- not illustrating -- automatic frequency control -- (-- AF --) -- a circuit -- outputting .
[0021] At the time of reception operation in which it is in the above circuitry and the antenna switch 12 is connected to a receive-section 13 side The RF signal received by the antenna 11 in process in which the RF circuit 17 is reached [from the antenna switch 12] through the electrostatic capacitive detector 15 and the reception matching circuit 16 The electrostatic capacity between the antenna 11 from which the electrostatic capacitive detector 15 changes according to the distance between the antenna 11 in the time and the human body of the user of this terminal, and the housing of this terminal is detected, and the obtained electrostatic capacity value is outputted to the matching control section 18.
[0022] Matching with the impedance of the antenna 11 which the impedance to the RF signal with which the reception matching circuit 16 is transmitted through the electrostatic capacitive detector 15 is changed, and changes according to the distance between the above-mentioned antenna 11 and the human body of the user of this terminal as a result because the matching control section 18 which received this sends out the control signal corresponding to the value of the electrostatic capacity to the reception matching circuit 16 is taken.
[0023] Therefore, though the distance between an antenna 11 and this user's human body changes with use of this terminal at the time of reception operation, the actual gain of an antenna 11 can be held to the always optimal value, and the best possible reception operation can be performed.
[0024] Moreover, since detection by the low frequency band is sharply performed as compared with the RF signal used for communication, fully let influence on communication operation which measurement takes be a low thing.
[0025] Next, in process in which the transmitting output of the RF signal which the RF circuit 19 outputs is carried out from an antenna 11 through the transmitting matching circuit 20, a directional coupler 21, and the antenna switch 12 at the time of the send action by which the antenna switch 12 is connected to the transmitting section 14 side, a part of RF signal branches with a directional coupler 21, and it is **(ed) by the VSWR detector 22.
[0026] In the VSWR detector 22, VSWR which changes according to the distance between the antenna 11 in the time and the human body of the user of this terminal is detected, and the acquired value is outputted to the transmitting output control section 23 and the warning generating section 24.
[0027] The transmitting output control section 23 is what suppresses suitably the output level of the RF signal for the display which the RF circuit 19 outputs with the value of the VSWR corresponding to the distance between an antenna 11 and the human body of the user of this terminal. In the state where especially the value of VSWR is judged that the antenna 11 is close or touches a user's human body, the output level of a signal which transmits shall be reduced even to the minimum in the range which can communicate, and the influence which it has to a user's human body shall be reduced as much as possible.
[0028] In addition, although the composition of the gestalt of the above-mentioned implementation explained as what detects the electrostatic capacity between the housing capitals of an antenna 11 and this terminal as a means to detect the distance of the antenna 11 at the time of reception operation, and the human body of the user of this terminal, it is good also as what otherwise detects the input impedance or VSWR of an antenna 11.
[0029] Although explained as what similarly detects VSWR as a means to detect the distance of the antenna 11 at the time of a send action, and the human body of the user of this terminal, it is good also

as what otherwise detects the electrostatic capacity between an antenna 11 and the housing of this terminal.
[0030] moreover -- although the case where the gestalt of the above-mentioned implementation is applied to a PHS terminal is illustrated -- this invention -- not only this but carrying -- if it is an usable communication device, applying to all is possible In addition, let this invention be what has possible deforming variously and carrying out within limits which do not deviate from the summary.
[0031]
[Effect of the Invention] According to invention according to claim 1, the operating characteristic of the antenna which changes according to the distance of a user's human body and an antenna on the occasion of use can be compensated, and reception operation by always high antenna efficiency can be performed.
[0032] According to invention according to claim 2, the influence which gives a transmitting output to a user's human body on the occasion of use by carrying out adjustable control from the property of the antenna which changes according to the distance of a user's human body and an antenna on the occasion of use can be suppressed as much as possible.
[0033] Since detection by the low frequency band is sharply performed [according to invention according to claim 3] as compared with the RF signal used for communication in addition to an effect of the invention the above-mentioned claim 1 or given in two, fully let influence on communication operation which measurement takes be a low thing.
[0034] According to invention according to claim 4, in addition to an effect of the invention the above-mentioned claim 1 or given in two, reception or a send action can be performed, maintaining antenna efficiency in the high state.

[Translation done.]

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CLAIMS

[Claim(s)]
[Claim 1] The pocket communication device characterized by providing the following. Antenna The receiving circuit which performs reception to the electric wave received with this antenna The impedance adjustable means which is arranged between the above-mentioned antenna and a receiving circuit, and carries out adjustable [of the impedance matching state between these] A measurement means to measure the property of the above-mentioned antenna, and control means which control the above-mentioned impedance adjustable means based on the measurement result of this measurement means, and take the impedance matching between the above-mentioned antenna and a receiving circuit
[Claim 2] The pocket communication device characterized by providing an antenna, the sending circuit which sends out and excites a RF signal at this antenna, a measurement means to measure the property of the above-mentioned antenna, and the control means which carry out adjustable control of the transmitting output of the above-mentioned sending circuit based on the measurement result of this measurement means.
[Claim 3] The above-mentioned measurement means is a pocket communication device according to claim 1 or 2 characterized by detecting the electrostatic capacity of an antenna.
[Claim 4] The above-mentioned measurement means is a pocket communication device according to claim 1 or 2 characterized by detecting VSWR (voltage standing wave ratio) of an antenna.

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PRIOR ART

[Description of the Prior Art] carrying of recently, a a digital cellular phone terminal, a PHS (Personal Handyphone System:short form cordless telephones system) terminal, etc. -- the spread of the terminals of an usable telephone system is progressing quickly
[0003] In this kind of pocket transmitter, as shown in drawing 2 , at the time of use, an antenna 1 will approach or contact a user's human body head 2 extremely. Therefore, the technical problem that electric field strong in this head 2 occurred occurred. Moreover, the property changed a lot because an antenna 1 approaches the human body head 2, and there was also fault that antenna actual gain will fall.

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EFFECT OF THE INVENTION

[Effect of the Invention] According to invention according to claim 1, the operating characteristic of the antenna which changes according to the distance of a user's human body and an antenna on the occasion of use can be compensated, and reception operation by always high antenna efficiency can be performed.
[0032] According to invention according to claim 2, the influence which gives a transmitting output to a user's human body on the occasion of use by carrying out adjustable control from the property of the antenna which changes according to the distance of a user's human body and an antenna on the occasion of use can be suppressed as much as possible.
[0033] Since detection by the sharply low frequency band is performed [according to invention according to claim 3] as compared with the RF signal used for communication in addition to an effect of the invention the above-mentioned claim 1 or given in two, let influence on communication operation which measurement takes be a thing low enough.
[0034] According to invention according to claim 4, in addition to an effect of the invention the above-mentioned claim 1 or given in two, reception or a send action can be performed, maintaining antenna efficiency in the high state.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] As mentioned above, electric field strong in this head arose, the human body might be affected, and it had the technical problem that it might fall also in an operating characteristic because an antenna approaches or contacts a human body head in a general pocket transmitter at the time of use.
[0005] It is in offering the pocket communication device to which this invention was made in view of the above actual condition, and the place made into the purpose carries out influence which it has on a user's human body on the occasion of use few, and an operating characteristic is not reduced.

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MEANS

[Means for Solving the Problem] The receiving circuit to which invention according to claim 1 performs reception to the electric wave received with an antenna and this antenna, The impedance adjustable means which is arranged between the above-mentioned antenna and a receiving circuit, and carries out adjustable [of the impedance matching state between these], It is characterized by providing a measurement means to measure the property of the above-mentioned antenna, and the control means which control the above-mentioned impedance adjustable means based on the measurement result of this measurement means, and take the impedance matching between the above-mentioned antenna and a receiving circuit.
[0007] The operating characteristic of the antenna which changes according to the distance of a user's human body and an antenna on the occasion of such composition, then use can be compensated, and reception operation by always high antenna efficiency can be performed.
[0008] Invention according to claim 2 is characterized by providing an antenna, the sending circuit which sends out and excites a RF signal at this antenna, a measurement means to measure the property of the above-mentioned antenna, and the control means which carry out adjustable control of the transmitting output of the above-mentioned sending circuit based on the measurement result of this measurement means.
[0009] The influence which gives a transmitting output to a user's human body on the occasion of use by carrying out adjustable control from the property of the antenna which changes according to the distance of a user's human body and an antenna on the occasion of such composition, then use can be suppressed as much as possible.
[0010] Invention according to claim 3 is characterized by the above-mentioned measurement means detecting the electrostatic capacity of an antenna in invention the above-mentioned claim 1 or given in two. Since detection by the low frequency band is sharply performed as compared with the RF signal used for communication in addition to an operation of invention such composition then the above-mentioned claim 1, or given in two, fully let influence on communication operation which measurement takes be a low thing.
[0011] Invention according to claim 4 is characterized by the above-mentioned measurement means detecting VSWR (voltage standing wave ratio) of an antenna in invention the above-mentioned claim 1 or given in two. In addition to an operation of invention such composition then the above-mentioned claim 1, or given in two, reception or a send action can be performed, maintaining antenna efficiency in the high state.
[0012]
[Embodiments of the Invention] With reference to a drawing, one gestalt of operation of this invention is explained below. Drawing 1 shows a part of circuitry at the time of applying to for example, a PHS terminal, 11 is an antenna which performs sending-out reception, and this antenna 11 is connected with a receive section 13 and the transmitting section 14 through the antenna switch 12. Here, the antenna switch 12 carries out change operation a predetermined period with the signal from the control circuit which is not illustrated, and the TDD (time-sharing duplex) method with which it takes to this and a

receive section 13 and the transmitting section 14 repeat reception operation and a send action by turns is taken.

[0013] A receive section 13 consists of the electrostatic capacitive detector 15, a reception matching circuit 16, an RF circuit 17, and the matching control section 18. The electrostatic capacitive detector 15 is process in which the electric wave received with the antenna 11 through the antenna switch 12 is transmitted to the reception matching circuit 16, detects that the electrostatic capacity between an antenna 11 and the housing of this terminal changes according to the distance between an antenna 11 and the human body of the user of this terminal, and outputs the detection result to the above-mentioned matching control section 18.

[0014] The matching control section 18 sends out the control signal corresponding to the detection result in the electrostatic capacitive detector 15 to the reception matching circuit 16. By changing the impedance to the RF signal with which the reception matching circuit 16 is transmitted from the electrostatic capacitive detector 15 based on the control signal from this matching control section 18 Matching with the impedance of the antenna 11 which changes according to the distance between the human bodies of the user of this terminal is taken, and it outputs to the RF circuit 17 of the next step.

[0015] In the RF circuit 17, the local oscillation signal of predetermined frequency is superimposed on the input signal of the inputted RF, an intermediate frequency signal is obtained, and it sends out to the processing circuit of the latter part which does not illustrate this. On the other hand, the transmitting section 14 consists of the RF circuit 19, the transmitting matching circuit 20, a directional coupler 21, a VSWR detector 22, the transmitting output control section 23, and the warning generating section 24.

[0016] By superimposing the local oscillation signal of predetermined frequency on the intermediate frequency signal sent from the processing circuit of the transmitting system which is not illustrated, the RF circuit 19 acquires a RF signal and sends out the acquired RF signal to the transmitting matching circuit 20.

[0017] In the transmitting matching circuit 20, after taking predetermined impedance matching to the sent signal, it outputs to a directional coupler 21. While a directional coupler 21 carries out the transmitting output of most sending signals of the sent RF from an antenna 11 through the above-mentioned antenna switch 12, it branches and sends out a part to the VSWR detector 22.

[0018] The VSWR detector 22 detects VSWR (voltage standing wave ratio) of the signal sent from the directional coupler 21 which changes according to the distance between an antenna 11 and the human body of the user of this terminal, and outputs the detection result to the transmitting output control section 23 and the warning generating section 24.

[0019] The transmitting output control section 23 is controlled to suppress the output of the sending signal which the above-mentioned RF circuit 19 outputs according to the degree, when it is judged that the antenna 11 is extremely close to the human body of the user of this terminal according to the value of VSWR detected with the VSWR detector 22.

[0020] warning -- generating -- the section -- 24 -- VSWR -- a detector -- 22 -- having detected -- VSWR -- a value -- predetermined -- a threshold -- comparing -- things -- the need -- an alarm signal -- generating -- a sending signal -- frequency -- controlling -- not illustrating -- automatic frequency control -- (-- AF --) -- a circuit -- outputting .

[0021] At the time of reception operation in which it is in the above circuitry and the antenna switch 12 is connected to a receive-section 13 side The RF signal received by the antenna 11 in process in which the RF circuit 17 is reached [from the antenna switch 12] through the electrostatic capacitive detector 15 and the reception matching circuit 16 The electrostatic capacity between the antenna 11 from which the electrostatic capacitive detector 15 changes according to the distance between the antenna 11 in the time and the human body of the user of this terminal, and the housing of this terminal is detected, and the obtained electrostatic capacity value is outputted to the matching control section 18.

[0022] Matching with the impedance of the antenna 11 which the impedance to the RF signal with which the reception matching circuit 16 is transmitted through the electrostatic capacitive detector 15 is changed, and changes according to the distance between the above-mentioned antenna 11 and the human body of the user of this terminal as a result because the matching control section 18 which received this

sends out the control signal corresponding to the value of the electrostatic capacity to the reception matching circuit 16 is taken.
[0023] Therefore, though the distance between an antenna 11 and this user's human body changes with use of this terminal at the time of reception operation, the actual gain of an antenna 11 can be held to the always optimal value, and the best possible reception operation can be performed.
[0024] Moreover, since detection by the sharply low frequency band is performed as compared with the RF signal used for communication, let influence on communication operation which measurement takes be a thing low enough.
[0025] Next, in process in which the transmitting output of the RF signal which the RF circuit 19 outputs is carried out from an antenna 11 through the transmitting matching circuit 20, a directional coupler 21, and the antenna switch 12 at the time of the send action by which the antenna switch 12 is connected to the transmitting section 14 side, a part of RF signal branches with a directional coupler 21, and it is **(ed) by the VSWR detector 22.
[0026] In the VSWR detector 22, VSWR which changes according to the distance between the antenna 11 in the time and the human body of the user of this terminal is detected, and the acquired value is outputted to the transmitting output control section 23 and the warning generating section 24.
[0027] The transmitting output control section 23 is what suppresses suitably the output level of the RF signal for the display which the RF circuit 19 outputs with the value of the VSWR corresponding to the distance between an antenna 11 and the human body of the user of this terminal. In the state where especially the value of VSWR is judged that the antenna 11 is close or touches a user's human body, the output level of a signal which transmits shall be reduced even to the minimum in the range which can communicate, and the influence which it has to a user's human body shall be reduced as much as possible.
[0028] In addition, although the composition of the form of the above-mentioned implementation explained as what detects the electrostatic capacity between the housing capitals of an antenna 11 and this terminal as a means to detect the distance of the antenna 11 at the time of reception operation, and the human body of the user of this terminal, it is good also as what otherwise detects the input impedance or VSWR of an antenna 11.
[0029] Although explained as what similarly detects VSWR as a means to detect the distance of the antenna 11 at the time of a send action, and the human body of the user of this terminal, it is good also as what otherwise detects the electrostatic capacity between an antenna 11 and the housing of this terminal.
[0030] moreover -- although the case where the form of the above-mentioned implementation is applied to a PHS terminal is illustrated -- this invention -- not only this but carrying -- if it is an usable communication device, applying to all is possible In addition, let this invention be what has possible deforming variously and carrying out within limits which do not deviate from the summary.

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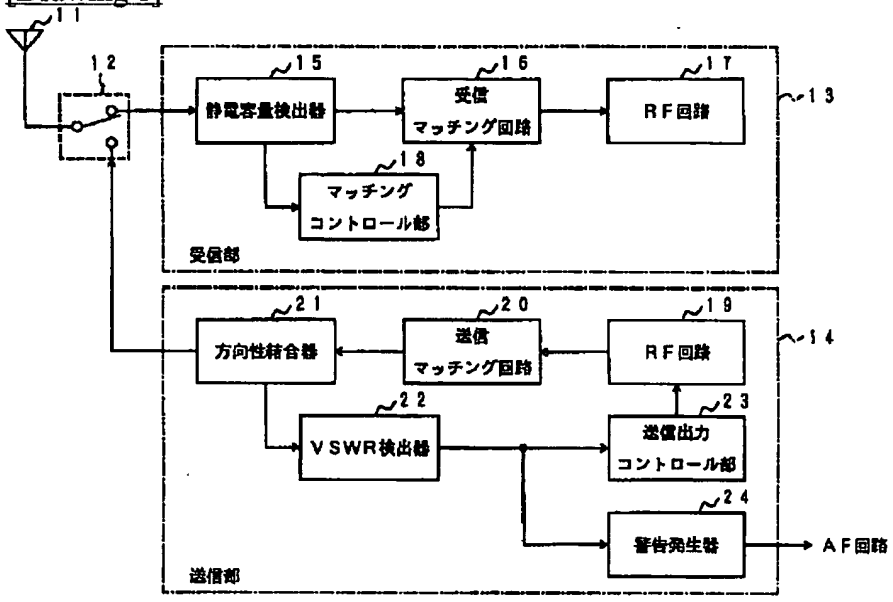
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram showing a part of circuitry concerning one gestalt of operation of this invention.
[Drawing 2] Drawing which illustrates the busy condition of a pocket transmitter.
[Description of Notations]
11 -- Antenna
12 -- Antenna switch
13 -- Receive section
14 -- Transmitting section
15 -- Electrostatic capacitive detector
16 -- Reception matching circuit
17 -- RF circuit
18 -- Matching control section
19 -- RF circuit
20 -- Transmitting matching circuit
21 -- Directional coupler
22 -- VSWR detector
23 -- Transmitting output control section
24 -- Warning generating section

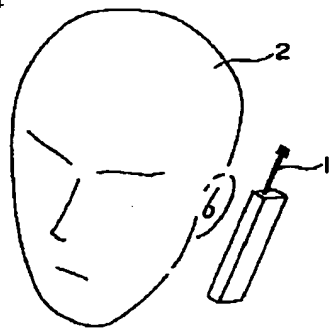
[Translation done.]

DRAWINGS

[Drawing 1]



[Drawing 2]



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(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号

特開平11－308142

(43)公開日　平成11年(1999)11月5日

(51)Int.Cl.[6]	識別記号	ＦＩ		
Ｈ０４Ｂ　1/40		Ｈ０４Ｂ　1/40		
1/04		1/04		Ｅ

審査請求　未請求　請求項の数４　ＯＬ　（全５頁）

(21)出願番号　特願平10－110747

(22)出願日　平成10年(1998)４月21日

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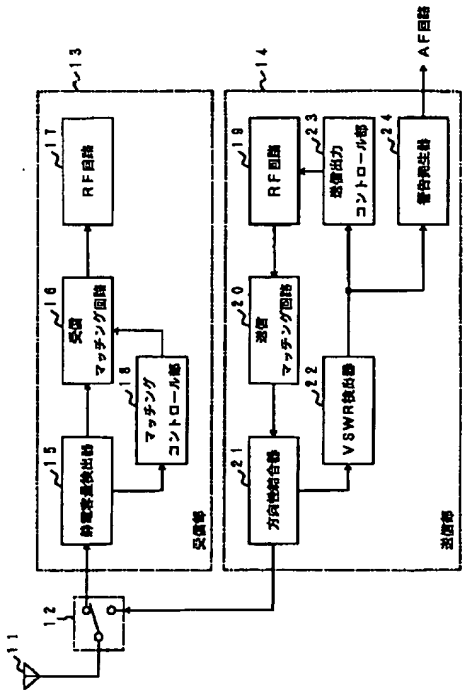
(74)代理人　弁理士　鈴江　武彦　（外５名）

(54)【発明の名称】　携帯通信装置

(57)【要約】
【課題】使用に際して使用者の人体に与える影響を極力低減し、また動作特性を低下させない。
【解決手段】アンテナ11と、このアンテナ11で受信した電波に対する受信処理を行なうＲＦ回路17と、アンテナ11とＲＦ回路17との間に配置され、これらの間のインピーダンス整合状態を可変する受信マッチング回路16と、アンテナ11とこの端末機筐体間の静電容量を計測する静電容量検出器15と、この静電容量検出器15の検出した静電容量値に基づいて受信マッチング回路16を制御し、アンテナ11とＲＦ回路17との間のインピーダンス整合をとらせるマッチングコントロール部18とを備える。



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【特許請求の範囲】
【請求項1】　アンテナと、
このアンテナで受信した電波に対する受信処理を行なう受信回路と、
上記アンテナと受信回路との間に配置され、これらの間のインピーダンス整合状態を可変するインピーダンス可変手段と、
上記アンテナの特性を計測する計測手段と、
この計測手段の計測結果に基づいて上記インピーダンス可変手段を制御し、上記アンテナと受信回路との間のインピーダンス整合をとる制御手段とを具備したことを特徴とする携帯通信装置。
【請求項2】　アンテナと、
このアンテナに高周波信号を送出して励振する送信回路と、
上記アンテナの特性を計測する計測手段と、
この計測手段の計測結果に基づいて上記送信回路の送信出力を可変制御する制御手段とを具備したことを特徴とする携帯通信装置。
【請求項3】　上記計測手段は、アンテナの静電容量を検出することを特徴とする請求項1または2記載の携帯通信装置。
【請求項4】　上記計測手段は、アンテナのＶＳＷＲ（電圧定在波比）を検出することを特徴とする請求項1または2記載の携帯通信装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、デジタル携帯電話機やＰＨＳ端末機等の携帯通信装置に関する。
【０００２】
【従来の技術】近時、デジタル携帯電話機やＰＨＳ（Ｐｅｒｓｏｎａｌ　Ｈａｎｄｙｐｈｏｎｅ　Ｓｙｓｔｅｍ：簡易型コードレス電話システム）端末機などの携帯使用可能な電話システムの端末機の普及が急速に進んでいる。
【０００３】この種の携帯通信機では、図2に示すように使用時にはアンテナ1が使用者の人体頭部2にきわめて近接あるいは接触することとなる。そのため、該頭部2内に強い電界が発生するという課題があった。また、アンテナ1が人体頭部2に近付くことでその特性が大きく変化し、アンテナ動作利得が低下してしまうという不具合もあった。
【０００４】
【発明が解決しようとする課題】上述した如く一般の携帯通信機では、使用時にアンテナが人体頭部に近接あるいは接触することで、該頭部内に強い電界が生じて人体に影響を与える可能性もあり、動作特性においても低下してしまうことがあるという課題を有していた。
【０００５】本発明は上記のような実情に鑑みてなされたもので、その目的とするところは、使用に際して使用者の人体に与える影響を少なくし、また動作特性を低下させてしまうこともない携帯通信装置を提供することにある。

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【０００６】
【課題を解決するための手段】請求項1記載の発明は、アンテナと、このアンテナで受信した電波に対する受信処理を行なう受信回路と、上記アンテナと受信回路との間に配置され、これらの間のインピーダンス整合状態を可変するインピーダンス可変手段と、上記アンテナの特性を計測する計測手段と、この計測手段の計測結果に基づいて上記インピーダンス可変手段を制御し、上記アンテナと受信回路との間のインピーダンス整合をとる制御手段とを具備したことを特徴とする。
【０００７】このような構成とすれば、使用に際して使用者の人体とアンテナとの距離に応じて変化するアンテナの動作特性を補償し、常に高いアンテナ効率での受信動作を実行することができる。
【０００８】請求項2記載の発明は、アンテナと、このアンテナに高周波信号を送出して励振する送信回路と、上記アンテナの特性を計測する計測手段と、この計測手段の計測結果に基づいて上記送信回路の送信出力を可変制御する制御手段とを具備したことを特徴とする。
【０００９】このような構成とすれば、使用に際して使用者の人体とアンテナとの距離に応じて変化するアンテナの特性から送信出力を可変制御することで、使用に際して使用者の人体へ与える影響を極力抑制することができる。
【００１０】請求項3記載の発明は、上記請求項1または2記載の発明において、上記計測手段は、アンテナの静電容量を検出することを特徴とする。このような構成とすれば、上記請求項1または2記載の発明の作用に加えて、通信に使用する高周波信号に比して大幅に低い周波数帯域での検出を行なうため、計測に要する通信動作への影響を充分に低いものとすることができる。
【００１１】請求項4記載の発明は、上記請求項1または2記載の発明において、上記計測手段は、アンテナのＶＳＷＲ（電圧定在波比）を検出することを特徴とする。このような構成とすれば、上記請求項1または2記載の発明の作用に加えて、アンテナ効率を高い状態で維持しながら受信または送信動作を実行することができる。
【００１２】
【発明の実施の形態】以下図面を参照して本発明の実施の一形態を説明する。図1は例えばＰＨＳ端末機に適用した場合の回路構成の一部を示すもので、11は送出受信を行なうアンテナであり、このアンテナ11はアンテナスイッチ12を介して受信部13及び送信部14と接続されている。ここでは図示しない制御回路からの信号によりアンテナスイッチ12が所定周期で切換動作し、これに連れて受信部13と送信部14とが交互に受信動

作と送信動作とを繰返すTDD（時分割デュプレックス）方式を採る。

【0013】受信部13は、静電容量検出器15、受信マッチング回路16、RF回路17、及びマッチングコントロール部18から構成される。静電容量検出器15は、アンテナスイッチ12を介してアンテナ11で受信した電波を受信マッチング回路16に伝送する過程で、アンテナ11とこの端末機の使用者の人体との間の距離に応じてアンテナ11とこの端末機の筐体との間の静電容量が変化するのを検出するもので、その検出結果を上記マッチングコントロール部18に出力する。

【0014】マッチングコントロール部18が、静電容量検出器15での検出結果に対応した制御信号を受信マッチング回路16に送出し、受信マッチング回路16がこのマッチングコントロール部18からの制御信号に基づいて静電容量検出器15から伝送されてくる高周波信号に対するインピーダンスを変化させることで、この端末機の使用者の人体との間の距離に応じて変化するアンテナ11のインピーダンスとのマッチングをとり、次段のRF回路17に出力する。

【0015】RF回路17では、入力された高周波の受信信号に所定周波数の局部発振信号を重畳して中間周波信号を得、これを図示しない後段の処理回路へ送出する。一方、送信部14は、RF回路19、送信マッチング回路20、方向性結合器21、VSWR検出器22、送信出力コントロール部23、及び警告発生部24から構成される。

【0016】RF回路19は、図示しない送信系の処理回路から送られてきた中間周波信号に所定の周波数の局部発振信号を重畳することで高周波信号を得、得た高周波信号を送信マッチング回路20に送出する。

【0017】送信マッチング回路20では、送られてきた信号に対して所定のインピーダンスマッチングをとった上で方向性結合器21に出力する。方向性結合器21は、送られてきた高周波の送信信号の大部分を上記アンテナスイッチ12を介してアンテナ11より送信出力させる一方、一部を分岐してVSWR検出器22に送出する。

【0018】VSWR検出器22は、アンテナ11とこの端末機の使用者の人体との間の距離に応じて変化する、方向性結合器21から送られてきた信号のVSWR（電圧定在波比）を検出するもので、その検出結果を送信出力コントロール部23及び警告発生部24へ出力する。

【0019】送信出力コントロール部23は、VSWR検出器22で検出したVSWRの値に応じてアンテナ11がこの端末機の使用者の人体にきわめて近接していると判断した場合にその度合いに応じて上記RF回路19の出力する送信信号の出力を抑制するように制御する。

【0020】警告発生部24は、VSWR検出器22で

検出したVSWRの値を所定のしきい値と比較することで必要により警告信号を発生し、送信信号の周波数を制御する図示しない自動周波数制御（AF）回路に出力する。

【0021】上記のような回路構成にあって、アンテナスイッチ12が受信部13側に接続される受信動作時には、アンテナ11により受信された高周波信号がアンテナスイッチ12から静電容量検出器15、受信マッチング回路16を介してRF回路17に至る過程で、静電容量検出器15がその時点でのアンテナ11とこの端末機の使用者の人体との間の距離に応じて変化するアンテナ11とこの端末機の筐体との間の静電容量を検出し、得た静電容量値をマッチングコントロール部18に出力する。

【0022】これを受けたマッチングコントロール部18が、その静電容量の値に対応した制御信号を受信マッチング回路16に送出することで、受信マッチング回路16が静電容量検出器15を介して伝送されてくる高周波信号に対するインピーダンスを変化させ、結果として上記アンテナ11とこの端末機の使用者の人体との間の距離に応じて変化するアンテナ11のインピーダンスとのマッチングをとる。

【0023】したがって、受信動作時にこの端末機の使用によりアンテナ11と該使用者の人体との間の距離が変化したとしても、アンテナ11の動作利得を常に最適な値に保持することができ、でき得る限り良好な受信動作を実行することができる。

【0024】また、通信に使用する高周波信号に比して大幅に低い周波数帯域での検出を行なうため、計測に要する通信動作への影響を充分に低いものとすることができる。

【0025】次に、アンテナスイッチ12が送信部14側に接続される送信動作時には、RF回路19の出力する高周波信号が送信マッチング回路20，方向性結合器21、及びアンテナスイッチ12を介してアンテナ11より送信出力される過程で、高周波信号の一部が方向性結合器21により分岐されてVSWR検出器22に共される。

【0026】VSWR検出器22では、その時点でのアンテナ11とこの端末機の使用者の人体との間の距離に応じて変化するVSWRを検出し、得た値を送信出力コントロール部23及び警告発生部24に出力する。

【0027】送信出力コントロール部23は、そのVSWRの値によりアンテナ11とこの端末機の使用者の人体との間の距離に対応してRF回路19の出力する表示のための高周波信号の出力レベルを適宜抑制するもので、特にVSWRの値がアンテナ11が使用者の人体に近接あるいは接触していると判断される状態では、送信する信号の出力レベルを通信が可能な範囲で最小限にまで低下させ、使用者の人体へ与える影響を極力低減させ

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るものとする。

【００２８】なお、上記実施の形態の構成では、受信動作時のアンテナ１１とこの端末機の使用者の人体との距離を検出する手段としてアンテナ１１とこの端末機の筐体都の間の静電容量を検出するものとして説明したが、他にアンテナ１１の入力インピーダンスあるいはＶＳＷＲを検出するものとしてもよい。

【００２９】同様に、送信動作時のアンテナ１１とこの端末機の使用者の人体との距離を検出する手段としてＶＳＷＲを検出するものとして説明したが、他にアンテナ１１とこの端末機の筐体との間の静電容量を検出するものとしてもよい。

【００３０】また、上記実施の形態は、ＰＨＳ端末機に適用した場合を例示したものであるが、本発明はこれに限らず、携帯使用可能な通信装置であればいずれにも適用することが可能である。その他、本発明はその要旨を逸脱しない範囲内で種々変形して実施することが可能であるものとする。

【００３１】

【発明の効果】請求項１記載の発明によれば、使用に際して使用者の人体とアンテナとの距離に応じて変化するアンテナの動作特性を補償し、常に高いアンテナ効率での受信動作を実行することができる。

【００３２】請求項２記載の発明によれば、使用に際して使用者の人体とアンテナとの距離に応じて変化するアンテナの特性から送信出力を可変制御することで、使用に際して使用者の人体へ与える影響を極力抑制することができる。

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【００３３】請求項３記載の発明によれば、上記請求項１または２記載の発明の効果に加えて、通信に使用する高周波信号に比して大幅に低い周波数帯域での検出を行なうため、計測に要する通信動作への影響を充分に低いものとすることができる。

【００３４】請求項４記載の発明によれば、上記請求項１または２記載の発明の効果に加えて、アンテナ効率を高い状態で維持しながら受信または送信動作を実行することができる。

【図面の簡単な説明】

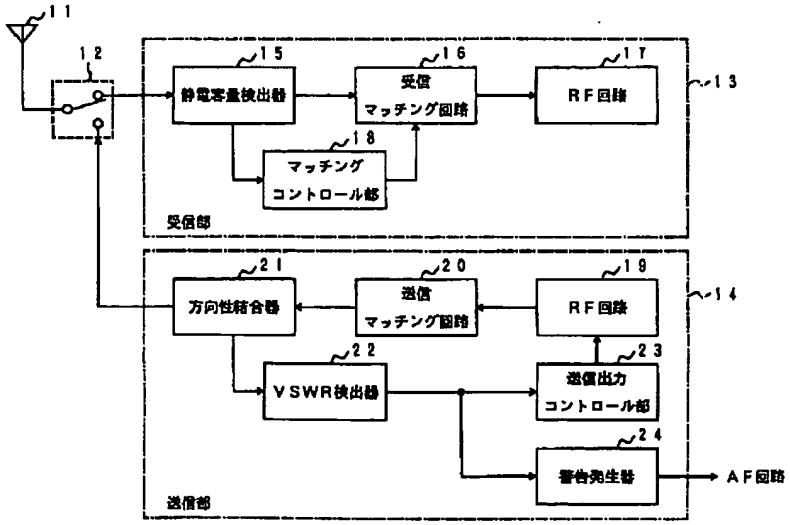
【図１】本発明の実施の一形態に係る回路構成の一部を示すブロック図。

【図２】携帯通信機の使用状態を例示する図。

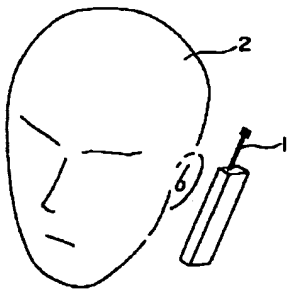
【符号の説明】

１１…アンテナ
１２…アンテナスイッチ
１３…受信部
１４…送信部
１５…静電容量検出器
１６…受信マッチング回路
１７…ＲＦ回路
１８…マッチングコントロール部
１９…ＲＦ回路
２０…送信マッチング回路
２１…方向性結合器
２２…ＶＳＷＲ検出器
２３…送信出力コントロール部
２４…警告発生部

【図１】



【図2】



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